Ulysses Field and Plasma Observations of Magnetic J1oIcs in the Solar Wind and Their Relation to Mirror-Mode Structures

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The term "magnetic hole" has been used to denote isolated intervals when the magnitude of the interplanetary magnetic field drops to a few tenths, or less, of its ambient value for a time that corresponds to a linear dimension of tens to a few hundreds of proton gyro-radii. 1 Data obtained by the U] ysses magnetometer and solar wind analyzer have been combined to study the properties of such magnetic holes in the solar wind between 1 and 5 AU and up to 45° S. latitude. in order to avoid confusion with decreases in field strength at interplanetary discontinuities, the study has focused on linear holes across which the field direction changed by less than .S°. '1 he holes occurred preferentially, but not without exception, in the interaction regions on the leading edges of high-speed solar wind streams. The plasma β and anisotropy indicate that the ambient plasma surrounding the holes is marginally stable against the mirror-mode instability. That finding, together with the observations that the plasma density and thermal pressure were greater within the holes than in the ambient wind leads to the suggestion that linear magnetic holes in the solar wind are remnants of mirror mode structures. The proton and alpha-particle distribution functions measured inside the holes sometimes exhibit the flattened phase-space-cicnsity contours in $v_\perp$-$v_\parallel$ space found in numerical simulations of the mirror mode instability.

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